

## ABSTRACT

All optical regeneration methods and systems can be realized through an exponential amplifier and a limiting amplifier, which could be two independent devices (one piece of fiber with parametric amplification and a semiconductor optical amplifier  
5 operating at saturation state) or one single device (one piece of fiber). The signal quality and the extinction ratio after regeneration are significantly improved compared with the degraded incoming data using a parametric amplifier with the data signal to be regenerated as the pump. The regenerated data has an extinction ratio as high as 14 dB, an extinction ratio enhancement of approximately 5 dB and an approximately 5 dB  
10 negative power penalty. This regeneration schemes are format transparent (RZ and NRZ), and provide noise reduction both for bit 1's and bit 0's of the data sequence. The regeneration method and apparatus that just utilizes fibers has the additional capability of ultrafast response speed (several femtoseconds due to the Kerr effect).